

3,252,470

Filed Feb. 19, 1962

INVENTORS.
Richard J. Elty and
Donald J. Gracz
BY *Walter H. Popp.*
ATTORNEY.

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3,252,470 ALTITUDE-COMPENSATING, CONSTANT-FLOW, OXYGEN REGULATOR

Richard J. Elly and Donald J. Gracz, Buffalo, N.Y., assignors to Scott Aviation Corporation, Lancaster, N.Y., a corporation of New York

Filed Feb. 19, 1962, Ser. No. 173,976

2 Claims. (Cl. 137-64)

This invention relates to an automatic oxygen supply regulator of the constant-flow type which is extremely sensitive to changes in altitude.

The main object of the invention is to provide a regulator of this type which can be adapted to provide widely different flow characteristics by merely changing a single component part thereof.

Other objects of the invention and practical solutions thereof are described in the following description and are illustrated in the accompanying drawing, wherein:

FIG. 1 is a partly diagrammatic, fragmentary, vertical, longitudinal section through the regulator, showing it in its closed position.

FIG. 2 is a graph having a family of "curves" illustrating how the regulator may be altered by the changing of a single one of its components to suit three different flow characteristics.

To expedite the description, the invention will be explained precisely as it is illustrated but it is to be definitely understood that the legal scope of the invention is to be measured solely by its inherent patentable novelty and by the breadth of the appended claims.

It is also to be understood that by the adjective "constant-flow" is meant an emergency type of regulator which is adapted to supply oxygen to a plurality of breathing masks which are not of the demand type but are of the orifice type and hence require oxygen at a definite pressure to function properly, irrespective of how many of the breathing masks are at the time being employed for breathing purposes.

Oxygen under variable but relatively high pressure is adapted to be received by the oxygen pipe 5 and flow through a main control valve 6 to a first stage pressure regulator 7 and thence through an oxygen conducting pipe 8 to an inlet 10, the latter consisting of a chamber formed in a regulator casing 11. Also arranged in said casing 11 is a vertical control valve 9 which is adapted to seat upon a resilient valve seat 12 and thereby to control the flow of oxygen from said inlet 10 to an outlet 13 by way of a duct 14 which is formed transversely in the externally threaded sleeve 15.

Said control valve 9 is provided with a depending stem 16 whose lower end is threaded into a collar 17 and into a lock nut 18, a compression spring 20 being coaxially arranged intermediate to the bottom of said sleeve 15 and the top of said collar 17 to ensure that the control valve 9 will always be closed whenever it is not being forced to its open position.

The bottom face of the lock nut 18 bears downwardly against the top face of an annular bellows head 21 which is brazed to the top end of the corrugated bellows 22. The lower end of said bellows 22 is brazed to an annular, externally threaded plug 23 which is provided with an O ring 24. Within said bellows 22 is situated a compression spring 25 which is adjusted by an externally threaded, hollow, adjusting sleeve 26 and is frictionally locked in an adjusted position by a nylon ("Nylock") locking block 27.

Said bellows 22 is located in an "outlet pressure chamber" 28 which communicates with the outlet 13 by reason of leakage around the stem 16 of the control valve 9. The interior of said bellows communicates with a balancing chamber 30 through the bore of the hollow

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adjusting sleeve 26. The cylindrical space below the plug 23 provides an access opening to plug 23 and sleeve 26 and is sealed off by a cap 31 provided with male threads 32 and an O ring 33.

An orifice 34 communicates through conduit pipes 35 and 8 with the inlet 10 and through conduit pipe 36 with the balancing chamber 30.

At the outer end of said balancing chamber 30 is an interchangeable valve seat sleeve 37 provided with male threads 38 and a valve seat 40, the latter being adapted to be opened and closed by an exhaust valve 41 that is secured to the inner face of a dual aneroid 42. Said valve seat sleeve 40 is held frictionally in place by a resilient washer 39. Said aneroid is provided with a coaxial, threaded stud 43 which is clamped to an externally threaded disk 44 which is provided with ambient holes 45 whereby the pressure in the ambient chamber 46, in which the aneroid 42 is situated, is maintained at ambient pressure. Adjustment of said aneroid and its exhaust valve 41 relatively to the valve seat 40 is effected by rotating the threaded disk 44 in the one or other direction.

OPERATION

Any attempt to control the outlet pressure of a constant-flow regulator by direct means is confronted by the fact that is difficult to both delicately control the outlet pressure and at the same time maintain such a control when the volume of flow varies between wide limits. The regulation in the present invention is effected indirectly, and uses the pressure in the oxygen flowing through the regulator to effect its own pressure control.

When the consumption of oxygen increases in volume, the pressure in the outlet 13 and in the outlet pressure chamber 28 is caused to drop. This allows the substantially constant pressure in balancing chamber 30 to quickly expand the bellows 22 and to thereby open the control valve 9. But this pressure in said balancing chamber 30 is not precisely the same pressure as that in the inlet 10 but is a function of the amount of bleeding of oxygen through the exhaust valve 41 which is, in turn, a function of the altitude of the airplane. Thus, practically the full power of the oxygen pressure in the inlet 10 is used to open the control valve 9, but is delicately modified by a relatively small amount of oxygen bleeding through the exhaust valve 41 in accordance with any change of altitude.

FIG. 2 (Chart)

One of the important features of the present invention is that it may be inexpensively altered to provide widely varying pressure and volume characteristics. In the present invention this is effected by merely putting in the desired valve seat sleeve 37.

We can obtain, for instance, with one sleeve 37, an outlet pressure rate with respect to altitude as shown in curve A. With a second sleeve, we can obtain the pressure rate characteristic of curve B. With a third sleeve, we can obtain still another linear characteristic, as shown by curve C. Thus the manufacturer is able to easily fill various specification requirements by merely choosing a sleeve 37 having the proper bore or passage size.

In this chart of FIG. 2, the abscissa scales at the bottom of said chart indicate both the ambient p.s.i.'s measured in absolute pressures and also the corresponding altitudes in thousands of feet, assuming zero at sea level. The vertical ordinate scale at the left represents the p.s.i. outlet pressure corresponding to the different altitudes or ambient pressures for three different interchangeable valve seat sleeves 37.

We claim:

1. An altitude-compensating, constant-flow, oxygen

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regulator adapted to control the supply of oxygen to one or more breathing masks comprising a casing having an inlet, an outlet from said casing communicating with said inlet, a control valve carried by said casing for controlling flow from said inlet to said outlet, an outlet pressure chamber in said casing communicating with said outlet, a bellows within said outlet pressure chamber, plug means mounting said bellows adjacent one end thereof for supporting said bellows within said outlet pressure chamber, the other end of said bellows being arranged to open said control valve upon expansion of said bellows, a balancing chamber in said casing, conduit means placing said balancing chamber in communication with said inlet, said conduit means including a restricted orifice, means including an aneroid controlled exhaust valve carried by said casing in communication with said balancing chamber for bleeding the same, means providing a seat for said exhaust valve, said last mentioned means comprising a valve seat sleeve carried by said casing and having a bore communicating with said balancing chamber, said valve seat sleeve being removable from said casing for substitution of another valve seat sleeve having a different size bore, means including a sleeve through said bellows supporting plug means placing the interior of said bellows in communication with said balancing chamber, and a compression spring seated on said last-named sleeve within said bel-

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lows for expanding said bellows, means providing an access opening in said casing to said compression spring sleeve, removable cap means normally closing said access opening, said compression spring sleeve being adjustable in said bellows supporting plug means through said access opening and without disconnecting said conduit means upon removal of said cap means for adjusting the spring pressure on said bellows.

2. An altitude compensating regulator as set forth in claim 1, wherein said bellows supporting plug means comprises a plug releasably secured in said casing and removable through said access opening upon removal of said cap means.

References Cited by the Examiner

UNITED STATES PATENTS

1,585,732	5/1926	Otto	251—61.1
1,800,995	4/1931	Gaunt	251—363 X
2,306,382	12/1942	Frink	137—64
2,963,034	12/1960	Cummins	137—81 X
2,969,801	1/1961	Cummins	137—81 X
3,094,141	6/1963	Maienknecht	137—505.25

ISADOR WEIL, *Primary Examiner*.

M. CARY NELSON, *Examiner*.

J. DEATON, R. GERARD, *Assistant Examiners*.